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ABSTRACT

Measurement properties of the written rules tests were examined to determine their suitability for assessing driver knowledge and skill. It was concluded that the tests, as measurement tools for granting or renewing a driver's license, were not adequate. Recommendations for test improvement and a sample test copy are included. (AG)

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DEVELOPMENT OF MEASURES FOR A DRIVER LICENSING PROGRAM IN THE STATE OF NORTH CAROLINA

Phase I: Analyses of Current Licensing Tests

Norman E. Freeberg

and

F. Reid Creech

July 1971

EDUCATIONAL TESTING SERVICE
PRINCETON, NEW JERSEY

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Development of Measures for A Driver Licensing Program in the State of North Carolina

Phase I: Analyses of Current Licensing Tests

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INTRODUCTION

Study Purpose

The process of evaluating driver capability, for purposes of granting or maintaining an operator's license, constitutes a state function that has undergone little systematic appraisal of its effectiveness. In most states, written tests and driver performance measures are utilized with inadequate (if any) knowledge of their value, so that few guidelines are available on which to base improvements in the licensing procedures currently applied.

The purpose of the present study is to examine the measurement properties of the driver licensing tests used in the state of North Carolina, in order to determine their suitability for assessing driver knowledge and skill. On the basis of these analyses, it is expected that appropriate modifications can be recommended which might eventually enhance the effectiveness of evaluation procedures used by the state in its driver licensing decisions. Since the licensing practices and evaluative procedures of North Carolina can be considered reasonably representative of a number of states in the country, it is also assumed that the findings would possess some degree of relevance to state licensing programs in general.

Any attempt to define the value of measures used in driver licensing and to achieve meaningful improvements assume, primarily, that: (a) the

goals or intentions of a driver licensing program can be defined and measured adequately, (b) the data needed to arrive at conclusions about existing licensing procedures are available from the information system in usable form, and (c) there is sufficient research knowledge regarding assessment of driver skills to provide a basis for appropriate modifications--or complete revision--of the existing appraisal methods (i.e., the state-of-the-research art has advanced sufficiently). The extent to which these broad assumptions can be met is not always clear and usually remains unspecified, since each implies complex, underlying issues that range from the social, legal and administrative to the statistical and methodological. A number of the issues will be touched on over the course of this paper insofar as they affect analyses of current licensing tests and the implementation of recommended improvements.

The analyses of driver licensing tests to be undertaken here can be viewed only as an initial phase of a proposed longer range study program, intended to develop a usable assortment of evaluation tools that might yield significant improvement over the existing licensing procedures (Freeberg, 1970). In effect, examination of presently used measures provides a form of "base-line" data against which any modifications to those measures (or newly designed evaluation techniques) can be compared. Also intrinsic to the study is an opportunity to examine the adequacy with which long-term performance outcomes, or criteria (e.g., reported accidents and violations), can be obtained and utilized. The ability to measure such agreed-upon goals of a licensing program accurately represents an important step in demonstrating the relative value of any licensing procedures.

Goals and Assumptions of Driver Licensing

Attempts to improve the evaluative tools for driver licensing require, at minimum, a degree of common understanding concerning the broad goals or intentions of the licensing procedures, since those goals can impose restrictive guidelines on development of more effective driver testing methods and on their eventual incorporation in a licensing system.

Probably the most comprehensive long range intent of driver licensing, on which overall agreement can be reached, is the state's desire to grant permission for operation of a motor vehicle to those who demonstrate the ability to do so safely and in a manner consistent with the state's legal codes (North Carolina State Department of Motor Vehicles, 1970). Standards of good driver performance would, therefore, encompass the ability to drive without causing damage and injury to oneself, or others, and without incurring citations for violation of existing traffic laws. However, within such a broad goal statement, there are several more specific, but unexamined, intentions in licensing program practices that require clarification if evaluative techniques are to be improved or applied sensibly. One overriding and fairly explicit intent is that the driver licensing tests serve a selection function and, in effect, screen out those drivers who fail to meet basic "minimum requirements for safe driving" (State of North Carolina, 1970, p. 107). The intent carries with it an assumption that minimum test standards can be specified and justified--i.e., that some optimum cutoff point(s) can be defined which will (at an acceptable level of probability) serve to eliminate those applicants least likely to be "good" drivers and, at the same time, license those who would be acceptable. This selection model of driver testing has been challenged as to its tenability (i.e.,

practicality) and criticized as wasteful of the evaluative potential of measures applied to a licensing system in which most applicants are eventually granted the license (Miller & Dimling, 1969). In its place, a guidance or classification approach has been suggested as more fruitful, since the intent would be to define levels of capability for any given driver in a number of skill areas. Such information could then be utilized to define the educational steps needed to bring the driver to some desired performance level. Where appropriate, this same information is seen as useful in guiding the imposition of conditions and licensing restrictions on drivers who are unable to meet one, or more, of the skill level requirements.

Under either a selection or classification approach to driver testing, however, it remains essential that the licensing measures bear some degree of significant relation to standards of "good" driver performance (i.e., that they be valid). That requirement for test validity carries with it, in turn, a second major assumption underlying most programs of evaluation for driver licensing purposes which is: that suitable outcome measures or criteria reflecting program success (i.e., "good" driver performance) are available over the course of the individual's driving career. Recorded violations and accidents have invariably served as the long-term outcomes of choice in most research efforts. Unfortunately, recorded frequency of accidents and violations, as maintained in many state data systems, constitutes less than perfect information regarding the true extent of those occurrences (Coppin, McBride, & Peck, 1965). For example, many and perhaps most violations go undetected and unreported. This is also the case (but probably to a lesser degree) for a significant proportion of accidents--particularly those designated as "minor" under the state legal codes and in which insufficient damage is inflicted to

require an entry in the record system. Furthermore, the precision of these criterion measures, as a reflection of driver capability, is weakened by inadequate (usually unavailable) information on driver "exposure" and the extent to which he is culpable for the accident occurrence. The inability to control for such variables, routinely, imposes a severe limitation on any licensing program that intends to set meaningful and objective performance standards.

For the most part, problems in defining explicit objectives for the licensing program and the relation between the licensing tests and those objectives have been avoided by tacitly assuming that the test scores possess "face validity." That is, the test is assumed to be an adequate representation of one's knowledge of the content of the state's Driver Handbook in and of itself. The reasoning is acceptable only if there is no further implication that a higher score on the written test reflects superior driver capability in any way. On a similar basis, better rated performance (i.e., a higher score)on a conventionally administered road test can be assumed to define "superior" driving skill, but this still remains only face valid until one demonstrates the relationship (predictive value) of that measure to later driving competence. Although reliance on face valid measures may stem from practical necessity in the conduct of a licensing program, justification of the tests solely on the basis of that assumption tends to stifle any attempts to improve currently used driver evaluation techniques. It is also in obvious contradiction to formal, stated, intentions of driver licensing laws which deal specifically with concepts of posttest "safety" and driving "ability" as goals (State of North Carolina, 1970).

The third relatively unexamined and untested major assumption of most driver licensing programs (and implicitly related to the two previous ones)

is that the system possesses a built-in, monitoring function capable of: (a) detecting "flaws" in driver performance on the basis of available information and (b) instituting appropriate corrective action intended either to restore suitable driver performance or to revoke the driving privilege . Detection of lapses in capability for licensed drivers is usually dependent on information derived from periodic license renewal examinations (written tests, road tests, eye tests, etc.), along with information about the frequency and nature of the driver's accident and violation involvement (e.g., usually based on some form of "point system"). Here again, however, one is essentially in the same position as with initial licensing evaluation, in being obliged to demonstrate, empirically, the effectiveness of such procedures when they are used to make licensing decisions. The problem faced in dealing with licensed drivers is to define levels of ineptitude that warrant given levels, or forms, of corrective action (i.e., How many violations, accidents or accumulated points warrant license withdrawal? For how long? When is a suitable level of driver capability restored?).

Evidence that bears on the acceptability of any of the above major intentions or assumptions, underlying state licensing procedures, is exceedingly scarce. What little direct evidence is available can not only be considered as incomplete, but also as failing to provide strong support for the effectiveness of conventional driver evaluation techniques applied during any phase of the licensing process. With regard to written tests of driver knowledge used for granting an initial license, for example, the only reported analyses have dealt with small samples (i.e., approximately 100 drivers) from two states (Michigan and Connecticut) and indicated little in the way or predictive validity against criterion ratings of driver proficiency (Eno

Foundation, 1948). Similarly, a test composed of driving maneuvers, derived from those used by a number of states in their initial licensing road tests, produced negligible validity when applied to groups of drivers classed as "accident," "violation-free" and "problem" drivers (McGlade, 1963). Analyses of the road test scores, used for initial licensing by North Carolina, also failed to demonstrate significant discriminability between drivers who had incurred accidents and those who were accident and violation free. However, individual items (maneuvers) for certain classes of driving skill (e.g., "physical handling of the automobile," "interaction with traffic") showed some discriminative value, but at levels that the investigator felt were minimal for practical predictive applications (McCrae, 1968).

In the monitoring of driving performance for persons already licensed, no efforts have been reported that deal with analyses or validation of license renewal examinations and only one attempt has been made to validate an operational accident-violation point system (Coppin & Peck, 1967). Evidence that is largely indirect would appear to substantiate some limited value for a monitoring system that incorporates accident and violation occurrences from driver history, in combination with such personal demographic characteristics as age, education, marital status, years of driving experience, miles driven, etc. (Coppin, McBride, & Peck, 1967; Goldstein, 1961, 1964). Unfortunately, as with other evaluative techniques, the practical value of the driver record and background information for predicting subsequent accidents and violations has been found to be severely limited--although considered by some investigators "encouraging" and worth future attempts to identify drivers who are likely to be greater safety risks (Coppin, McBride, & Peck, 1967).

Evidence bearing on the suitability of driver performance measures that can serve as licensing program outcomes (criteria) has also been sparse. The

need is to demonstrate which criterion variables and scoring methods provide the most defensible standards for validating licensing decisions or written tests. Recorded violations and accident occurrences,and associated forms of information (e.g., injuries and fatalities), have been--and are likely to continue--as the "ultimate" program standards required for administrative decisions. Too often, however, these must be accepted in whatever form they are recorded for the state's licensing system. Data organization and formats are often designed for retrieval and applications best suited to administrative purposes, rather than for research or study needs. Coupled with problems of format and accessibility, is the suspected lack of precision for criterion measures based solely on accident-violation occurrences (i.e., as previously mentioned, they often fail to represent the total accident and violation picture, as well as fail to take into account exposure and accident culpability for each driver). In addition, it should be mentioned, briefly, that accidents and violations are particularly difficult criterion variables to analyze by conventional statistical techniques because of the relative rarity of their recorded occurrences in the population, and the corresponding extreme skewness of their distributions (i.e., Poisson in shape). The effect, especially for accidents, is one that makes logical interpretation of results difficult, since it diminishes the reliability of any accident (or accident-dependent) measure, and severely restricts the ability to predict that criterion variable (Coppin, McBride, & Peck, 1965). Further increases in precision of measurement for accident-violation scores would appear dependent on additional, meaningful, forms of information about the characteristics of those occurrences in terms of the driver and the driving situation (e.g., driver exposure, severity

and nature of accidents, culpability, type and condition of automobile driven, etc.).

Part of the solution to the criterion problem has also been sought in the development of more readily available, standardized, driving-criterion tasks likely to be indicative of longer term driver capability. Here the attempt has been to define driver skills on the basis of a wide variety of "realistic" and carefully measured performance indices (Greenshields & Platt, 1969) that possess demonstrable relationships to driver accident and violation history. Development of more immediately available and more accurately measurable driver performance criteria, to supplement the longer term accident-violation measures, has been considered an important aspect of any future test validation and research efforts.

The Driver Licensing Process

As indicated previously,this study will be based on the driver licensing system of the State of North Carolina. In order to understand the study intent, its scope and the results presented, it is necessary to have a general understanding of the licensing procedures and requirements imposed by that state.

Typically, the applicant who desires a license to operate a private passenger vehicle, for the first time, must pass examinations that evaluate his: (1) visual acuity; (2) ability to identify, by color and shape, the standard traffic signs used on streets and highways; (3) knowledge of "traffic laws and safe driving practices" as determined by a 30-item Rules Test, available in either written or oral form; and (4) "actual driving ability" by means of a road test that is administered only to applicants who have

achieved a passing score on the first three examinations (North Carolina, Dept. of Motor Vehicles, 1969). In the event of failure to pass any of these licensing requirements the applicant may repeat them when he believes that he is ready to do so--although it is suggested in the Driver's Handbook that one week be allowed to lapse before reexamination.*

All operators' licenses are valid for four years from the year of issuance, at which time the licensee must undergo a renewal licensing examination (written or oral). This test is similar in format and content to the initial licensing rules test,but contains only 20 test items. (The renewal license applicant may, under unusual circumstances, be required to take a road test at the discretion of the examiner, but such a requirement is highly atypical.)

Continuity in the monitoring of driver ability and performance is achieved not only through the formal testing procedures but also through a penalty system of "points" assigned on the basis of convictions incurred for various minor traffic violations. A warning letter is sent to the licensee after four violation points are accumulated and another after the accumulation of seven points. License suspension is possible after 12 such penalty points have been assigned. Mandatory suspensions and revocations are also imposed for single violation occurrences of greater severity (e.g., driving while intoxicated, manslaughter, hit and run violation).

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*There are no formally prescribed limits set with regard to the time between examination and reexamination, or with regard to the number of times the applicant may be reexamined.

Scope of the Study

This report will focus exclusively on the written rules tests used for initial award of the driver's license and for license renewal. The suitability of the measures is to be determined,largely,on the basis of their internal measurement characteristics. Included in that determination will be the examination of item means (i.e., difficulty levels), variances, correlations of items with the total test score, the reliability of the total test, the underlying dimensions (or factors)that define the test content and, on the basis of those results, the overall comparability of various test forms that are administered interchangeably.

In addition, and perhaps most important, are analyses of the rules test capability to discriminate between "good" and "poor" drivers in terms of the accidents and violations that they have incurred (i.e., test validity). This analysis is possible in the present study for the written license renewal rules test forms only. By utilizing the recorded accident and violation occurrences (covering the four-year period prior to completion of the written renewal test) for a sample of renewal license applicants, it is possible to determine the relationship between those occurrences and the test scores. Such a post-hoc, or retrospective,study is somewhat less than ideal, since it entails an after-the-fact examination of the previous four-year driving performance record for those drivers who have remained in the state and retained their licenses (i.e., there is the likelihood of an unknown degree of selective bias). More desirable and more definitive would be a predictive,or prospective,validation in which the written rules test scores are correlated with posttest driver performance. The data necessary to accomplish that form of validation were

not available at the inception of this study, although they are in the process of being obtained.*

As an adjunct to analyses of the licensing tests, it is of value to consider whether scores on these measures, and subsequent driver performance, are influenced by different background characteristics of the applicants. Evidence to support the potential influence of driver characteristics or experiences on accident and violation involvement has been fairly extensive (Coppin, McBride, & Peck, 1967; Goldstein, 1964; McFarland & Moseley, 1954). Therefore, a small number of available background variables obtained from a driver personal data form were analyzed, in combination with the rules test scores, to determine the degree to which they might enhance the relationships between the written test scores and the accident-violation occurrences obtained from the driver history.

METHOD

Description of the Measures

Features of the licensing rules tests, accident and violation criteria and background data pertinent to the present study are as follows:

1. Initial Licensing Rules Test (Written form)--is a 30-item, untimed, paper and pencil measure available in five forms, each of which is similar in content and format. The test contains 20 items in four-choice, multiple-choice format and 10 items in a true-false format. Item subject matter is

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*Initial licensing rules test scores for renewal license applicants are not retained in the data system, so that a predictive (prospective) study was not possible with that group. However, determination of the predictive validity of the initial licensing rules tests is planned as part of a supplement to the present report, based on one year posttest accidents and violations for a sample of applicants tested in May 1969.

drawn solely from a handbook on "Traffic Law and Highway Safety" (State of North Carolina, 1970) which contains material describing the state's traffic rules and regulations, driving techniques and emergency procedures. All test items are given equal weight in the total score and a passing score is defined as 70% or more of the items answered correctly. (Test security prevents inclusion of any of the initial licensing test forms. However, some indication of the content of each item is presented in the tables of the Results and Discussion section.)

2. Renewal Licensing Rules Test (Written form)--is a 20-item measure in a four-choice multiple-choice format, with five available test forms; each form containing item material based on the "Driver's Refresher Handbook of Traffic Laws and Highway Safety" (State of North Carolina, 1969). That volume summarizes much of the material in the previously cited handbook used by initial license applicants. Each item is weighted equally and 14 or more items answered correctly (i.e., 70%) constitutes a passing score. An obsolete form of the renewal rules test can be seen in Appendix A. It should be noted that those items are identical in format and similar in content to those of the currently used renewal rules test forms and equally similar to the 20 multiple-choice items used in the initial licensing rules test.*

3. The Supplementary Data Form--contains some categories of information that are not customarily required as part of the formal renewal licensing procedure. It was administered, voluntarily, to a sample of renewal license

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*An oral, untimed test is also available in five forms for those applicants unable to read well enough to complete the written rules tests. The same five forms are used for initial and renewal licensing. However, the oral test is not logically amenable to detailed analyses as presently administered, since the examiner halts the presentation when the applicant fails more than 30% of the items. Interpretation of item characteristics for an untimed, uncompleted measure is considered to be of sufficiently questionable value to negate any detailed analyses of its measurement quality.

applicants at the time of renewal rules test administration. The form presented in Appendix D is designed to obtain--in as short a space as possible--some of the background information for which significant validity against accident-violation criteria had been claimed in previous studies. The information provided, that was found useful for analysis, includes education, sex, marital status, driving experience (years of driving), age of car and applicant's estimates of miles driven per week.

4. Recorded Accidents and Violations (Criteria)--were available from driver records that are maintained as part of the state licensing data system. The reported violations represent only those occurrences for which convictions were obtained; while the frequency of accident involvement represents those instances reported and confirmed by police accident reports. Recorded accidents are defined as those in which any person is killed, or injured, or $100 or more of property damage is incurred.

The total frequency of accidents and violations sustained over the four-year period,preceding administration of the written license renewal rules test, constituted the two criterion variables for renewal test validation purposes. The frequency scores for each variable were intended for use separately and in optimally weighted combination. However, the reader should be aware that the two measures are not completely independent and possess a degree of "spurious" overlap when they are used as combined criteria. Thus, although accident and violation frequency are correlated with each other in the present samples at a moderate level ($r \cong .40$),some undefined portion of that relationship results from the fact that accidents

can be accompanied by a violation conviction for one or more of the drivers involved.*

Study Samples

The samples consisted of 21,671 male and female applicants who completed the Initial Licensing Rules Test in Spring of 1969 and 8,187 male and female renewal license applicants who took the renewal rules test in January of 1970. Applicants were drawn from test centers throughout the state of North Carolina. Although the scores of those applicants who fail the tests are not normally retained in the data system, the procedure was changed for present study purposes so that all rules test scores were made available (i.e., the total range of scores for those who passed or failed the tests appears in this sample).**

The sample sizes for each of the five test forms of each rules test are about evenly divided over the total sample. That is, about 1,600 respondents comprise the sample that completed each form of the renewal licensing rules test and about 4,300 who completed each form of the written initial licensing examination. Exact sample sizes for each form are presented in the tabled results of the next section.

For the validation phase of the renewal rules test analyses, the sample was composed only of those drivers for whom complete data were available in

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*It was not feasible with the present data system to remove accident-free violations from the total number of violation occurrences for any given driver.

**It should be understood, however, that for either of the rules tests an undetermined number of applicants may have failed to pass the tests on one or more occasions prior to this administration. There is no way of identifying such individuals, or the number of previous test administrations, from the existing data system.

the form of the rules test score, background information and driver history. That sample totaled 4,474 males and females. Specific subsample sizes, by rules test form and sex, are appropriately indicated in the tabled results.

Data Analyses

Two major types of analyses are to be undertaken in order to determine the measurement characteristics and value of the various forms of the written renewal examinations. One involves analysis of rules test characteristics at both item and total scale levels. The other entails the validation of the renewal rules test, using accident and violation data as the driver performance criteria. As part of the latter analysis, the background variables are to be incorporated as predictors, along with the renewal rules test scores, in optimally weighted combination.

Specifically, the analyses are to deal with:

(1) Rules Test Characteristics--determined on the basis of (a) total scale reliabilities--as alpha coefficients, (b) item means or difficulty levels--as proportion of respondents passing each item, (c) spread of item scores--as item variance, (d) item "compatibility" with the total scale--as item, total-test score correlations and (e) underlying dimensions that define coherent item groupings or potential subscales--as factors obtained from a principal components analysis and a varimax rotation to orthogonality (Kaiser, 1954).

(2) Rules Test Validation--obtained from correlations between each of the written renewal rules test forms and the accident and violation occurrences recorded for each driver over the previous four-year period. The validity coefficients were obtained for accidents and

violations separately and for both variables in optimally weighted combination. Scores for the accident and violation criteria were derived from a square-root transformation of the accident and violation frequencies in an attempt to convert the highly skewed distributions to as nearly normal shapes as possible. (Because of the nature of these Poisson distributions, however, there was relatively minor benefit derived from that transformation.)

All correlations for the validation were computed separately for male and female samples.

(3) Background Correlates - - of driver accident and violation performance were obtained from the relationships between those criteria and the variables from the Supplementary Information Form. The correlations were computed between each of five background variables along with each renewal rules test form and each of the criteria (as zero-order r's). Optimally weighted combinations of those same predictors, with the optimally weighted composite of accidents and violations, were also correlated with one another (as canonical R's). These correlations were also computed for male and female samples separately.

RESULTS AND DISCUSSION

Initial Licensing Rules Test (Five Written Forms)

The measurement characteristics of the five forms of the initial licensing tests are shown in Tables 1 through 5 in terms of item difficulty levels (means), item variances, item-total test score correlations and total scale reliability estimates (alpha coefficients). In Tables 6 through 10, factor loadings are presented for those same test forms on five rotated varimax

factors. Further detailed information concerning the item characteristics has been reserved for Appendix B in terms of the proportion of times each item alternative was chosen. Such information serves to pinpoint the bases for the other results obtained and also serves as a major source of information in any attempt to modify the existing items.

From the results obtained,the following interpretations are possible:

1. Item Characteristics: The item means,or difficulty levels,shown in the first column of Tables 1 through 5,form a distinctly skewed distribution with items tending to be overly easy. The values indicate a relatively high probability that most applicants will answer any given item correctly. Specifically, on each of the five test forms it can be seen that the range of p values is in excess of .80 for as many as 8 of the 30 items in Form #1 to as many as 12 of the 30 items in Form #5. Correspondingly, there are relatively few items below the .50, or moderate difficulty level. The true-false items (21-30) account, proportionally, for the largest number of excessively easy items and none of the moderately difficult items. Some attempts at more optimum item "peaking" (Guilford, 1954) is clearly in order and it is apparent that the items in the T-F format are detrimental to the quality of the tests in this respect.

Item variability (presented in the second column of each table) is dependent directly on the item mean scores, such that variance is reduced to minimal levels for items having extreme values for their difficulty indices. Such minimal amounts of item variance tend to reduce the likelihood of finding useful overall test variance. Thus, the items with means falling between .30 and .70 can be said to show the most acceptable amounts of variance for inclusion in these measures.

Table 1

Initial Licensing Rules Test (Form #1)

Item Characteristics and Reliability Estimates

(N = 4352)

	Item	Mean (p)	Variance	Item-Total r
1.	Brake & clutch operation	.48	.25	.36
2.	Braking distance	.52	.25	.44
3.	Speed regulations	.65	.23	.38
4.	Use of lights	.35	.23	.25
5.	Accident statistics	.41	.24	.33
6.	Safe following distance	.68	.22	.45
7.	Pedestrian regulations	.70	.21	.38
8.	Hand signals	.91	.08	.37
9.	Traffic signs	.66	.23	.38
10.	Accident statistics	.49	.25	.28
11.	Intersection regulations	.81	.15	.37
12.	Traffic circle regulations	.53	.25	.46
13.	Accident statistics	.76	.19	.46
14.	School bus laws	.85	.13	.41
15.	Time allowance for trips	.53	.25	.39
16.	"Safety-Responsibility Law"	.63	.23	.39
17.	Accident statistics	.53	.25	.39
18.	Licensing regulations	.81	.16	.40
19.	Licensing rules	.70	.21	.35
20.	Accident statistics	.70	.21	.32
21.	Signal regulations	.86	.12	.27
22.	Passing regulations	.60	.24	.31
23.	Reaction time	.82	.15	.34
24.	Automotive facts	.75	.19	.31
25.	Accident statistics	.62	.24	.37
26.	Speed limits	.69	.22	.40
27.	Intersection rules	.86	.12	.38
28.	Use of lights	.63	.23	.23
29.	Safe driving habits	.61	.24	.40
30.	Intersection regulations	.91	.08	.29

Coefficient alpha = .74

Total Test Mean = 20.0
Total Test SD = 4.8

Table 2

Initial Licensing Rules Test (Form #2)

Item Characteristics and Reliability Estimates

(N = 4360)

	Item	Mean (p)	Variance	Item-Total r
1.	Speed regulations	.37	.23	.23
2.	Safe driver attitude	.79	.17	.46
3.	Control of car	.58	.24	.55
4.	Traffic laws (road safety)	.88	.11	.42
5.	Reaction time	.66	.22	.37
6.	Railroad crossing regulations	.56	.25	.40
7.	Emergency traffic control	.83	.14	.51
8.	Passing regulations	.84	.13	.35
9.	Clover-leaf regulations	.61	.24	.48
10.	Accident statistics	.57	.25	.37
11.	Passing regulations	.58	.24	.35
12.	Response to emerg. veh. signals	.85	.13	.23
13.	Time allowance for trips	.58	.24	.35
14.	Accident statistics	.68	.22	.34
15.	Car maintenance	.87	.11	.45
16.	Speed regulations	.56	.25	.31
17.	Traffic circle regulations	.63	.23	.42
18.	Accident statistics	.94	.06	.41
19.	Rate of speed	.34	.22	.32
20.	Accident statistics	.50	.25	.33
21.	Causes of skidding	.84	.14	.30
22.	Hand signals	.70	.21	.28
23.	Passing regulations	.60	.24	.30
24.	Life of tire	.67	.22	.29
25.	Road signs	.67	.22	.43
26.	Good driving habits	.78	.17	.46
27.	Braking - road conditions	.80	.16	.41
28.	Accident statistics	.57	.24	.37
29.	Use of lights	.63	.23	.20
30.	Dangers of drinking	.88	.11	.36

Coefficient alpha = .75

Total Test Mean = 20.3
Total Test SD = 4.8

Table 3

Initial Licensing Rules Test (Form #3)

Item Characteristics and Reliability Estimates

(N = 4207)

	Item	Mean (p)	Variance	Item-Total r
1.	Use of signals	.71	.21	.32
2.	Use of signals	.64	.23	.33
3.	Accident statistics	.68	.22	.33
4.	Operating procedures	.69	.21	.46
5.	Reaction time	.67	.22	.32
6.	Safe night driving	.67	.22	.44
7.	Intersection regulations	.62	.24	.42
8.	Accident reporting	.81	.15	.39
9.	"Safety Responsibility Law"	.68	.22	.41
10.	Safe driving habits	.93	.06	.42
11.	Accident statistics	.65	.23	.45
12.	Operating procedures	.70	.21	.41
13.	Intersection regulations	.79	.17	.43
14.	Licensing regulations	.86	.12	.38
15.	Road markings	.82	.15	.43
16.	Braking distance	.50	.25	.42
17.	Parking rules	.62	.24	.34
18.	Permit regulations	.89	.10	.35
19.	Braking laws	.43	.25	.30
20.	Safe driving habits	.82	.15	.47
21.	Passing regulations	.60	.24	.31
22.	Intersection regulations	.84	.13	.22
23.	Hand signals	.69	.21	.29
24.	Reaction time	.80	.16	.39
25.	Automotive facts	.75	.19	.30
26.	Causes of skidding	.84	.14	.34
27.	Road signs	.69	.21	.45
28.	Intersection regulations	.91	.08	.34
29.	Safe driving - slippery pavement	.84	.14	.40
30.	Life of tire	.67	.22	.27

Coefficient alpha = .75

Total Test Mean = 21.8
Total Test SD = 4.7

Table 4

Initial Licensing Rules Test (Form #4)

Item Characteristics and Reliability Estimates

(N = 4351)

	Item	Mean (p)	Variance	Item-Total r
1.	School bus law	.97	.02	.23
2.	Driving hazards	.74	.19	.36
3.	License suspension rules	.65	.23	.26
4.	Licensing rules	.85	.13	.34
5.	Safe night driving	.68	.22	.43
6.	Passing capability	.32	.22	.33
7.	Changing lanes	.87	.11	.28
8.	Traffic lights	.80	.16	.39
9.	Road markings	.87	.12	.43
10.	Intersection regulations	.44	.25	.43
11.	Parking rules	.60	.24	.33
12.	Expressway safe speed	.37	.23	.43
13.	Pedestrian regulations	.74	.19	.40
14.	Road conditions	.76	.18	.38
15.	Accident statistics	.65	.23	.45
16.	Operating procedures	.70	.21	.49
17.	Reaction time	.66	.22	.35
18.	Headlight regulations	.36	.23	.23
19.	Unobstructed vision	.91	.08	.36
20.	Speed regulations	.41	.24	.26
21.	Safe driving habits	.61	.24	.36
22.	Causes of skidding	.85	.13	.30
23.	Intersection regulations	.86	.12	.25
24.	Intersection regulations	.91	.08	.33
25.	Speed limits	.69	.21	.38
26.	Automotive facts	.75	.19	.36
27.	Dangers of drinking	.91	.09	.37
28.	Life of tire	.66	.22	.27
29.	Signal regulations	.88	.11	.27
30.	Reaction time	.84	.14	.34

Coefficient alpha = .72

Total Test Mean = 21.3
Total Test SD = 4.3

Table 5

Initial Licensing Rules Test (Form #5)

Item Characteristics and Reliability Estimates

(N = 4401)

Item	Mean (p)	Variance	Item-Total r
1. Traffic laws	.88	.11	.41
2. Permit regulations	.92	.08	.33
3. Reaction time	.68	.22	.32
4. Speed regulations	.63	.23	.38
5. Signal usage	.73	.20	.37
6. Road markings	.91	.08	.43
7. Road markings	.64	.23	.45
8. Car maintenance	.88	.11	.50
9. Intersection regulations	.47	.25	.38
10. Railroad crossing safety	.83	.14	.43
11. Accident statistics	.50	.25	.33
12. Accident statistics	.78	.17	.31
13. Use of lights	.70	.21	.31
14. Dangerous driving	.85	.13	.49
15. Car maintenance	.43	.25	.34
16. Speed requirements	.75	.19	.40
17. Accident statistics	.67	.22	.33
18. License suspension rules	.45	.25	.32
19. Changing lanes	.89	.10	.32
20. Use of lights	.63	.23	.37
21. Road signs	.68	.22	.45
22. Life of tires	.66	.22	.26
23. Carbon monoxide danger	.84	.13	.21
24. Good driving habits	.81	.15	.45
25. Intersection regulations	.87	.11	.41
26. Signal regulations	.87	.11	.29
27. Dangers of drinking	.91	.08	.37
28. Safe driving - slippery pavement	.78	.17	.37
29. Use of lights	.61	.24	.29
30. Safe driving habits	.59	.24	.40

Coefficient alpha = .74

Total Test Mean = 21.8
Total Test SD = 4.5

The item,total-test score correlations (third column of each table) simply reflect the degree to which each item measures something similar to the scale of which it is a part--i.e., the extent to which it "belongs" in the scale and its contribution to scale reliability. The values shown here, for this particular statistic, are fairly substantial (i.e., correlations largely in the .30's and .40's) and also indicate that the test forms are likely to show a reasonable degree of overall reliability or internal consistency.

A brief look at selection proportions for the items of each test form (Appendix B), suffices to indicate which items incorporate distractors having such low probability of selection that they are virtually sueless for their intended purpose (e.g., those with p values of less than .05).

2. Form Reliability: Alpha coefficients, shown at the bottom of each table, represent lower-boundary (conservative) estimates of internal consistency for each test form. These are uniformly high and similar from form to form (r's in the low to middle .70's), which is consistent with the pattern of item-total test correlations discussed above. Such levels of reliability are considered acceptable for a paper and pencil test, but represent only one necessary index of scale suitability and, certainly, not the primary one on which to base any decisions regarding the value of these initial licensing test forms.

3. Test Factors (Empirical Item Groupings): Loadings for the five factors extracted from each form,and rotated to orthogonality,are shown in Tables 6 to 10, along with the proportion of total test variance accounted for by each factor. Based on factor variances and the number of loadings of interpretable magnitude (i.e., .30 or greater), five factors were found to be

Table 6

Initial Licensing Rules Test (Form #1)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.04	.52	-.01	.24	-.00
2	.34	.21	-.05	.16	.35
3	.21	.37	.04	.05	.20
4	-.10	.63	.01	-.08	.09
5	.03	.06	-.01	.59	.17
6	.31	.17	.14	.18	.26
7	.20	.43	.12	.05	.00
8	.27	.21	.42	-.03	-.04
9	.15	.44	.19	.07	-.07
10	.02	.09	-.02	.59	-.13
11	.31	.20	.22	.02	-.00
12	.26	.30	.05	.34	.37
13	.38	.26	.20	.01	.17
14	.39	.19	.32	.10	-.20
15	.16	.15	.01	.37	.24
16	.34	.14	.17	.08	-.00
17	.43	.07	.00	.08	.16
18	.37	.01	.20	.27	-.04
19	.09	.15	.24	.21	.18
20	.16	-.04	.21	.41	-.09
21	-.04	.07	.50	.07	.09
22	.19	.11	-.02	-.05	.52
23	.39	.01	.22	-.03	.05
24	.01	-.14	.41	.35	.15
25	.51	-.11	-.07	.09	.26
26	.44	.22	.09	-.02	-.00
27	.27	.06	.47	.06	-.05
28	-.12	-.11	.27	.07	.66
29	.55	.01	-.05	.16	-.01
30	.06	.06	.57	-.03	.07
Percent of variance (from Principal Components)					
	13.6%	4.2%	4.0%	3.6%	3.6%

Table 7

Initial Licensing Rules Test (Form #2)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	-.03	-.02	.17	-.00	.62
2	.47	.10	.14	.11	.18
3	.43	.24	.36	-.18	.14
4	.47	.06	.16	.29	-.02
5	.18	.07	.41	.05	.09
6	.10	.35	.29	.06	.08
7	.57	.12	.18	.02	.09
8	.22	.18	.11	.46	.00
9	.22	.43	.33	.00	-.06
10	.23	.40	.00	-.04	.07
11	.17	-.01	.50	.03	-.07
12	.12	.05	-.03	.65	.02
13	.02	.15	.45	.08	.12
14	.16	.04	.20	.24	.33
15	.49	.00	.22	.19	.10
16	.17	.06	-.01	-.06	.65
17	.18	.41	.35	-.06	-.19
18	.52	-.03	.12	.39	.01
19	-.05	.13	.52	-.00	.18
20	.08	.35	.06	.05	.16
21	.42	-.03	.03	.12	.07
22	.07	.37	.07	.02	-.09
23	.00	.43	.12	.05	-.06
24	.03	.25	.16	.05	.17
25	.43	.28	.04	-.20	.08
26	.59	.07	.10	-.02	.03
27	.42	.22	.05	-.02	.02
28	.36	.34	-.14	-.26	.15
29	-.18	.59	-.26	.29	.17
30	.50	.09	-.08	.12	.02
	Percent of variance (from Principal Components)				
	14.8%	4.8%	3.8%	3.7%	3.5%

Table 8

Initial Licensing Rules Test (Form #3)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.01	-.00	.07	.66	.10
2	.16	-.03	.20	.41	-.05
3	.23	.24	-.09	.34	-.13
4	.24	.44	.10	.16	.02
5	.09	.54	-.13	.10	-.05
6	.21	.23	.07	.50	-.00
7	.34	.28	.20	.04	-.09
8	.21	.09	.26	.15	.26
9	.16	.39	.11	.09	.19
10	.58	.11	-.04	.09	.19
11	.20	.33	.31	.07	.07
12	.38	.14	.34	-.04	-.05
13	.45	.17	.08	.15	.00
14	.48	.07	.01	.05	.17
15	.51	.16	.18	.02	-.08
16	.07	.22	.47	.18	-.02
17	.23	.35	.20	-.20	-.07
18	.50	.00	-.04	.01	.30
19	.04	-.00	.60	-.03	-.03
20	.51	.14	.06	.22	.06
21	-.02	.05	.40	.17	.10
22	.03	.02	-.03	.04	.64
23	-.10	.00	.31	.40	.15
24	.14	.44	.18	-.01	.10
25	.01	.18	-.06	.32	.39
26	.36	-.08	.26	-.06	.29
27	.29	.11	.33	.26	-.01
28	.29	.08	.11	-.09	.49
29	.19	.22	.27	.02	.27
30	-.27	.54	.10	.05	.27
Percent of variance (from Principal Components)					
	14.4%	4.6%	3.9%	3.6%	3.5%

Table 9

Initial Licensing Rules Test (Form #4)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.01	.42	-.13	.02	.37
2	.40	.23	-.02	-.15	.14
3	-.08	.11	-.09	.43	.39
4	-.03	.32	.07	.22	.46
5	.35	.04	.20	-.03	.45
6	.43	-.04	-.01	.29	-.19
7	-.03	.52	.09	.05	.00
8	.26	.34	.07	.10	.04
9	.17	.47	.06	.26	.10
10	.45	.03	.17	.11	.07
11	.08	.15	.08	.48	-.08
12	.46	-.10	.13	.22	.23
13	.29	.17	.06	.39	-.04
14	.27	.12	.11	.26	.13
15	.42	.16	.13	.13	.09
16	.42	.16	.18	.22	.11
17	.29	.08	.15	.10	.04
18	.17	-.09	.10	-.21	.55
19	.16	.44	.09	.04	.14
20	.08	-.08	.04	.53	.00
21	.55	.08	-.11	-.03	.02
22	.12	.48	.14	-.05	-.19
23	.01	.17	.52	-.17	-.01
24	.07	.33	.41	.06	-.12
25	.47	.26	-.00	-.13	-.07
26	.10	.03	.50	.06	.22
27	.19	.46	.08	.02	.07
28	.04	-.14	.52	.12	.10
29	.01	.16	.38	.11	-.02
30	.20	.09	.46	.02	-.01
	Percent of variance (from Principal Components)				
	12.7%	4.4%	4.1%	3.8%	3.7%

Table 10

Initial Licensing Rules Test (Form #5)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.37	.39	-.07	.08	.12
2	.34	.25	-.06	-.03	.30
3	.12	.12	.35	.02	-.08
4	.21	.24	.04	.37	-.13
5	.23	.32	.01	.26	-.12
6	.42	.25	-.06	.06	.19
7	.39	.05	.23	.22	-.06
8	.50	.29	.10	.04	.14
9	.17	.33	.29	-.01	-.23
10	.28	.25	.33	-.05	.10
11	.11	.04	.36	.12	.10
12	.03	.41	.20	-.04	.16
13	-.00	.60	07	- 05	07
14	.61	.14	.10	-.00	.07
15	.01	.12	.48	.14	-.01
16	.27	.39	.03	.12	-.08
17	.18	-.03	.44	-.06	.17
18	-.05	.44	.16	.23	-.13
19	.19	.32	.06	-.08	.45
20	.07	.02	.11	.75	.11
21	.39	.03	.28	.21	-.20
22	-.09	.02	.56	.06	.06
23	.11	-.08	.02	.18	.49
24	.61	-.00	.13	-.03	.06
25	.52	.05	.03	.09	.07
26	.14	.04	.25	-.00	.50
27	.56	-.07	.06	-.02	.20
28	.34	.03	.26	.04	-.05
29	-.06	-.02	.12	.75	.14
30	.40	.09	.26	-.00	-.32
Percent of variance (from Principal Components)					
	14.5%	5.3%	4.1%	3.7%	3.6%

an adequate representation of the pattern and structure of these tests. In general, the factor patterns were similar across test forms in the variance accounted for, in the presence of one distinctly dominant factor and in the uniform uninterpretability of the factor patterns. There was, unfortunately, no clear meaning derivable from the item content that could be assigned to any of the item groupings, for any of the factors, on any of the test forms.* This result is not entirely surprising if (as is likely) the test items were selected solely to provide maximum coverage of the material in the Driver's Handbook and with no a priori intention of selecting sets of items that cover particular subject-matter areas (e.g., use of signals, maintenance of distance, emergency procedures, etc.).

Since there are no clearly definable, underlying, dimensions that appear to be tapped by these rules test forms, there is little guidance provided for identifying the most meaningful areas of driver knowledge that might be used in developing additional useful items, or in building more coherent subscales with more useful scoring procedures. However, a broad interpretation is possible, given test forms that are primarily unifactor in structure; with the factor a somewhat general one that explains the largest proportion of variance, by far. The dominant factor can best be conceived of as one reflecting "general knowledge" of Handbook content resulting, primarily, from reading skill (or verbal proficiency)--i.e., the one area of competence common to acquisition of such knowledge and to its demonstration in test

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*This lack of factor interpretability can be demonstrated by using the items of the sample test forms shown in Appendix A (Initial Licensing Rules Test, Form #1) and the factor loadings of Table 6. The resulting frustration that is encountered in attempting to assign meaning to the factors is identical over all five test forms.

performance. What is suggested, in effect, is that the test could be expected to rank driver applicants in a similar way if it were based on the ability to read and comprehend a cookbook. (Some indirect evidence to support such an interpretation is provided by significant and moderate levels of positive correlation found between the renewal licensing rules test scores and the applicant's level of formal education, that are to be reported in a subsequent section.)

The more critical question to be considered is, of course, whether or not the rules test is related to any aspects of driver performance. If the assumption is correct that the major skill component measured by these rules tests is heavily dependent on verbal proficiency then, on the basis of previous findings regarding the minimal relationship of intellectual skill to driver performance (Goldstein, 1961), there would be little reason to expect usable levels of correlation between rules test scores and post-test driver performance.*

4. Form Comparability: From visual inspection of the item characteristics, reliability estimates and factor structure it is apparent that a high degree of overall similarity exists among the five initial licensing rules test forms. Some differences that are relatively minor can be noted, for example, in contrasting forms #1 and #2 with the remaining three forms. Those two are most similar to one another in their distribution of item difficulties, their item-total test score correlations and their factor structure; while forms #3, #4, and #5 form a distinctly more comparable grouping. Again, however, such relatively minor differences in comparability

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*The planned report supplement dealing with an analysis of the relationship between the rules test and one year, posttest, accident and violation records will, of course, provide more direct evidence regarding this expectation than is possible with the present data.

Table 11

Number of Common Items between Test Forms

Initial Licensing Rules Test

	Form # 1	2	3	4	5
1		5	6	6	6
2			8	6	10
3				11	5
4					7
5					

would be expected if items from a pool were assigned to test forms on a relatively random basis and the forms administered to applicants without systematic bias. One complicating aspect of any assessment of form comparability for this exam, is that much of it is built-in, or artifactual, and can be attributed to the number of common items that occur between forms. In Table 11, the amount of item overlap is shown for the five initial licensing rules test forms. No fewer than 5 (16%) and as many as 11 (36%) of the items can be seen as common to any two test forms.

Renewal Licensing Rules Test (Five Written Forms)

In Tables 12 through 16, the item characteristics and test reliability estimates are presented for the five forms of the renewal licensing examination. The rotated factor loadings and accountable variance for each factor appear in Tables 17 to 21 for the same five forms. Item selection proportions are, again, appended (Appendix C) as information for possible use in modifying the existing items.

1. Item Characteristics: Item difficulty levels (means) shown in the first column of each table provide much of the basis for any expected value (or lack of value) likely to be found in these tests. On the basis of the difficulty indices alone, these measures are patently far less acceptable than the initial licensing rules tests. Mean values are seen to be greater than .80 for a large proportion of the items in each test form (i.e., from no fewer than 12, to as many as 14 of the 20 items).

From 7 to 10 of the 20 items in any form are excessively easy for the renewal applicants with resulting mean values of .90 or greater. The distorting effects of such distributions of item difficulty indices is so pronounced in its restriction of item variances (second column of each table)

Table 12

Written Renewal Rules Test

Item Characteristics (Form A)

(N = 1654)

	Item	Mean (p)	Variance	Item-Total r
1.	Traffic signs	.69	.21	.41
2.	License suspension rules	.43	.24	.36
3.	Passing regulations	.81	.15	.35
4.	Speed regulations	.64	.23	.40
5.	Speed regulations	.91	.08	.42
6.	Safe driver attitude	.90	.09	.48
7.	Speed regulations	.49	.25	.24
8.	Intersection regulations	.62	.23	.42
9.	Intersection regulations	.95	.04	.43
10.	Use of lights	.93	.06	.43
11.	Road markings	.95	.05	.52
12.	Pedestrian right of way	.85	.12	.35
13.	Passing	.94	.06	.42
14.	Braking distance	.53	.25	.39
15.	Use of lights	.95	.05	.42
16.	License regulations	.97	.03	.47
17.	Road markings	.76	.19	.45
18.	Speed regulations	.79	.17	.33
19.	Intersection regulations	.91	.08	.42
20.	Passing regulations	.94	.06	.40

Coefficient alpha = .64

Total Test Mean = 16.0
Total Test SD = 2.7

Table 13

Written Renewal Rules Test

Item Characteristics (Form B)

(N = 1634)

	Item	Mean (p)	Variance	Item-Total r
1.	Speed regulations	.81	.16	.37
2.	Traffic signs	.86	.12	.48
3.	Turning regulations	.85	.13	.37
4.	Interstate highway regulations	.96	.04	.44
5.	Traffic signs	.84	.13	.42
6.	School bus law	.99	.01	.35
7.	License suspension rules	.43	.24	.40
8.	Safe following distance	.69	.21	.39
9.	Traffic signs	.88	.11	.34
10.	Traffic lights	.90	.09	.42
11.	"Safety-Responsibility Law"	.76	.18	.50
12.	Pedestrian right of way	.84	.13	.38
13.	Intersection regulations	.91	.08	.44
14.	Speed regulations	.50	.25	.51
15.	Use of lights	.93	.06	.38
16.	License suspension rules	.79	.17	.34
17.	Safe driver attitude	.91	.08	.46
18.	Night driving safety	.71	.21	.53
19.	Speed regulations	.92	.07	.39
20.	Passing	.92	.08	.30

Coefficient alpha = .69

Total Test Mean = 16.4
Total Test SD = 2.9

Table 14

Written Renewal Rules Test

Item Characteristics (Form C)

(N = 1662)

Item	Mean (p)	Variance	Item-Total r
1. Speed regulations	.80	.16	.41
2. Traffic signs	.77	.18	.41
3. Intersection regulations	.80	.16	.43
4. Interstate highway accidents	.61	.24	.42
5. Use of lights	.53	.25	.27
6. Intersection regulations	.90	.09	.43
7. Safe following distance	.83	.14	.48
8. Hand signals	.94	.05	.31
9. School bus laws	.99	.01	.34
10. Use of lights	.95	.05	.36
11. Passing regulations	.94	.06	.28
12. Use of lights	.54	.25	.44
13. Accident reporting	.87	.11	.41
14. Speed regulations	.97	.03	.43
15. Intersection regulations	.88	.11	.43
16. Licensing rules	.98	.02	.32
17. Traffic circle regulations	.75	.19	.44
18. Night driving danger	.86	.12	.45
19. Clover-leaf regulations	.78	.17	.44
20. Safe driver attitude	.92	.07	.41

Coefficient alpha = .66

Total Test Mean = 16.6
Total Test SD = 2.7

Table 15

Written Renewal Rules Test

Item Characteristics (Form D)

(N = 1614)

	Item	Mean (p)	Variance	Item-Total r
1.	Passing regulations	.79	.17	.40
2.	Traffic lights	.90	.09	.37
3.	Intersection regulations	.91	.09	.37
4.	Point system penalties	.62	.24	.36
5.	School bus laws	.99	.01	.29
6.	Speed regulations	.56	.25	.41
7.	Response to police emerg. vehs	.83	.14	.26
8.	Accident frequency (statistics)	.75	.19	.35
9.	Changing lanes	.90	.09	.37
10.	Passing regulations	.86	.12	.35
11.	Accident reporting	.88	.11	.36
12.	Licensing rules	.97	.03	.40
13.	Traffic signs	.87	.11	.49
14.	Intersection right of way	.96	.04	.46
15.	Intersection right of way	.81	.16	.44
16.	Use of lights	.56	.25	.39
17.	Road markings	.96	.04	.34
18.	Safe driver attitude	.91	.08	.49
19.	Speed regulations	.92	.08	.36
20.	Intersection regulations	.59	.24	.44

Coefficient alpha = .63

Total Test Mean = 16.5
Total Test SD = 2.6

Table 16

Written Renewal Rules Test

Item Characteristics (Form E)

(N = 1623)

	Item	Mean (p)	Variance	Item-Total r
1.	Speed regulations	.86	.12	.34
2.	Hand signals	.95	.05	.32
3.	Accident reporting	.73	.20	.49
4.	Safe following distance	.82	.15	.52
5.	Intersection regulations	.94	.06	.28
6.	School bus laws	.99	.01	.26
7.	Passing regulations	.77	.18	.42
8.	Braking distance	.64	.23	.44
9.	Turning regulations	.88	.11	.33
10.	Licensing rules	.98	.02	.27
11.	Use of lights	.95	.05	.41
12.	Braking distance	.49	.25	.38
13.	Interstate highway regulations	.95	.04	.43
14.	Turning regulations	.90	.09	.44
15.	Use of lights	.93	.06	.39
16.	Safe driver attitude	.90	.09	.50
17.	Speed regulations	.43	.25	.33
18.	Point system schedule	.61	.24	.37
19.	Intersection regulations	.64	.23	.42
20.	Response to police emerg. sigs	.84	.13	.20

Coefficient alpha = .62

Total Test Mean = 16.2
Total Test SD = 2.6

that virtually all subsequent data analyses applied are likely to show adverse test characteristics. The source of the weaknesses in item characteristics are seen most immediately in the selection proportions of item alternatives (Appendix B). There is little question that large numbers of distractors serve no useful purpose when incorporated in these multiple-choice items. A variety of test parameters are likely to be distorted by such unfavorable item values and severely diminish the opportunity to demonstrate any "true" effectiveness that (with little more effort in item development) might have been possible for renewal test items of this type.

Any explanation, or justification, that attributes these item difficulty levels to the "superior" level of knowledge possessed by North Carolina renewal license applicants, might be difficult to support. In order to do so, one would have to argue for the "inherent" value of the knowledge of these particular rules and regulations and ignore completely any evidence dealing with whether or not a given level of such knowledge is sufficient to lead to acceptable driver performance in any way.

2. Form Reliabilities: The values are found to range over the low to high .60's for all five test forms. When contrasted with the initial licensing tests, this reduction in degree of internal consistency is most likely attributable to the difference in test length (i.e., 20 items as compared to 30). Since somewhat higher levels of reliability would be desirable, a longer renewal examination (probably 30 items or more in length) would be of value. However, given the greater detriment to test quality imposed by the item characteristics, reliability, as such, is of minor concern here for judging the adequacy of these measures.

3. Test Factors: The pattern of loadings for five rotated factors extracted from each test (Tables 16 through 21) are not only uninterpretable for any of the test forms, but they lack even the structural uniformity of a general or dominant factor as clear as the one that appeared in the initial licensing test forms. The dimensional features of these forms--based primarily on the number and magnitude of interpretable loadings for the five factors (i.e., in excess of .30)--are also seen as considerably different from form-to-form. Lack of interpretive qualities (i.e., meaningful item subgroups), or comparability of factor structure,can be attributed largely to the item inadequacies already mentioned; particularly the minimal amount of item variance available.

4. Form Comparability--is difficult to define meaningfully for these five renewal licensing test forms, except insofar as they can be considered "comparably-less-than-adequate" to distinguish between levels of driver knowledge of Handbook content.

Although the five forms are highly similar in their item characteristics and overall levels of reliability, much of this is built in (as in the case of the initial licensing rules tests). The extent of this item duplication, or overlap, is shown in Table 22 which indicates that anywhere from three to nine of the 20 test items are common from form to form. As will be seen below in discussion of the relationships between test forms, the driver background characteristics and the driver record (i.e., prior accidents and violations incurred), the pattern of correlations is also found to be fairly similar across test forms.

5. Renewal Rules Test Validity--obtainable from the correlations of the rules test scores with the driver's accident and violation occurrences, represents the initial opportunity to check the value of this written test

Table 17

Renewal Licensing Rules Test (Form A)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.08	.54	.18	-.07	-.18
2	-.15	.32	.56	.06	-.01
3	.10	-.19	.71	.15	.04
4	.21	.06	.49	-.24	.11
5	.32	.14	.28	.15	-.35
6	.45	.33	.12	-.06	-.00
7	.06	.04	.13	.01	.88
8	.12	.23	.41	-.03	-.04
9	.62	.06	.07	-.06	.06
10	.58	.17	.04	-.19	-.17
11	.70	.10	.12	-.06	-.04
12	.25	.44	-.10	-.08	.12
13	.46	.28	-.03	.09	.10
14	-.03	.59	.09	.20	.11
15	.57	.12	-.03	.14	.03
16	.67	.02	.03	.23	.04
17	.20	.44	.09	.23	-.10
18	.10	.18	-.03	.80	-.03
19	.49	-.04	.23	.07	-.18
20	.52	-.08	.10	.37	.01
Percent of variance (from Principal Components)	19.0%	6.9%	5.8%	5.2%	5.0%

Table 18

Renewal Licensing Rules Test (Form B)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.09	-.03	.30	.02	.54
2	.23	.61	.01	.07	.12
3	.11	.08	-.03	.15	.67
4	.56	.29	-.01	.06	.09
5	.34	.25	-.08	.35	.03
6	.62	-.08	.09	.04	.21
7	-.12	.22	.17	.64	-.04
8	-.01	.49	.10	-.01	.11
9	.07	.30	-.03	-.08	.52
10	.50	.42	-.04	.24	.05
11	.20	.37	.24	.29	-.03
12	.10	.07	.60	-.04	.08
13	.51	.20	.18	.03	-.01
14	-.06	.44	.27	.35	.13
15	.58	-.14	.15	.13	.15
16	.23	-.20	-.07	.67	.17
17	.37	.25	.38	.20	-.13
18	-.04	.28	.57	.09	.34
19	.28	-.04	.53	.18	-.05
20	.36	.04	.29	-.16	-.01
Percent of variance (from Principal Components)	17.7%	9.7%	5.5%	5.3%	5.1%

Table 19

Renewal Licensing Rules Test (Form C)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.15	.29	.21	.21	-.44
2	-.03	.31	.45	-.00	-.00
3	.02	.62	.02	.15	-.09
4	.09	.25	.39	.04	-.29
5	-.14	.13	-.21	.57	.23
6	.40	.25	-.00	.33	-.12
7	.01	.56	.30	.09	-.01
8	.61	-.03	.04	.05	-.04
9	.72	-.05	.10	.05	-.06
10	.28	.35	-.00	.12	.38
11	.09	.10	.23	.04	.63
12	-.01	-.02	.70	.09	.02
13	.28	.09	.43	-.01	.33
14	.64	.16	.04	.14	.16
15	.34	.38	.21	-.11	-.02
16	.49	.20	.05	-.09	.18
17	.15	-.01	.21	.62	-.05
18	.22	.04	.47	.21	.14
19	.07	.08	.18	.65	-.08
20	.14	.62	.00	.01	.23
Percent of variance (from Principal Components)	17.0%	7.0%	6.0%	5.5%	5.0%

Table 20

Renewal Licensing Rules Test (Form D)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.13	.37	.42	-.20	-.03
2	.14	.48	.03	-.02	.10
3	.05	.43	.32	.00	-.03
4	.01	-.00	.13	.12	.79
5	.61	-.02	.16	-.10	-.02
6	.09	.30	.02	-.12	.57
7	.30	-.30	-.04	.45	.26
8	.33	.08	-.21	.30	08
9	.36	.12	.16	.29	-.21
10	.08	.10	.25	.40	.01
11	.18	-.13	.70	.14	.06
12	.68	.11	.02	.08	.01
13	.43	.27	.31	-.05	.10
14	.62	.18	.04	.15	.10
15	.08	.50	.07	.25	-.00
16	-.05	.19	.07	.65	-.05
17	.32	.37	-.02	-.00	.01
18	.33	.44	.12	.10	.10
19	-.02	.16	.52	.19	.12
20	-.03	.55	-.05	.26	.11
Percent of variance (from Principal Components)					
	16.1%	6.3%	5.6%	5.2%	5.1%

Table 21

Renewal Licensing Rules Test (Form E)

Rotated Varimax Factor Loadings

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
1	.00	.19	.05	.69	-.05
2	.21	.43	.07	.02	.02
3	.32	.02	.34	.35	-.08
4	.44	.12	.11	.39	.03
5	-.03	.64	-.09	.33	-.09
6	.06	.66	.01	-.00	.18
7	.57	-.03	-.00	.06	-.07
8	.16	-.02	.21	.26	-.12
9	.09	-.10	.07	.56	.44
10	.20	.20	.04	.08	.37
11	.43	.15	.11	.05	.43
12	.01	-.00	.68	.03	.01
13	.59	.12	-.01	.00	.25
14	.52	.28	.09	-.12	.06
15	.36	.35	.09	-.02	.13
16	.60	.20	.07	.06	.06
17	.21	.26	.25	-.12	-.58
18	-.02	.08	.65	-.06	.20
19	.49	-.08	.03	.17	-.15
20	-.03	.16	.12	-.16	.47
Percent of variance (from Principal Components)					
	16.0%	6.6%	6.1%	5.5%	5.3%

Table 22

Number of Common Items between Test Forms

Renewal Licensing Rules Test

	Form A	Form B	Form C	Form D	Form E
A		4	8	7	8
B			6	4	3
C				8	6
D					9
E					

against an external performance standard. These product-moment correlations are shown in Table 23 for each of the five test forms by male and female subgroups.

As might have been expected from the results discussed above, concerning poor internal measurement characteristics for these renewal test forms (especially the highly restricted item variance), only minimal levels of relationship are found. Two of the 20 correlations reach a level significantly greater than zero and both of these occur with test form C. On that test form there is a very slight (and barely significant) tendency for those female applicants scoring high on the test to have incurred fewer violation convictions ($r = -.10$, $p < .05$). The one significant relationship for males is found for the criterion of accident occurrences ($r = -.16$, $p < .01$). It is not immediately clear from inspection of item characteristics or content why test form C should show such tendencies toward significant relationships with the criteria. But, in either event, these relationships are at levels that preclude any practical utility. The r of .16, for example, would provide less than a 3% improvement in predictive accuracy over a test having no relationship to the criteria. One weak, but hopeful, sign for potential posttest predictive validity (if, these renewal exams were to be constructed with more defensible item characteristics), is that the largest of the correlations, especially those for the accident criterion, are all in the expected direction (i.e., all are negative in sign).

Attempts to enhance the set of relationships by using the accidents and violations in optimally weighted combination (Table 24) do not produce any notable change for the multiple correlations obtained. The highest R of .16 ($p < .001$) for males on test form C is no better than the relationship achieved for the zero-order coefficients.

Table 23

Correlation Coefficients for Renewal License Rules Test with Driver Accidents and Violations (By Sex and Test Form)

Test Form		Violations	Accidents	N
A	Male	.01	-.06	522
	Female	.02	.04	368
B	Male	.02	-.08	522
	Female	-.08	-.02	396
C	Male	-.08	-.16**	513
	Female	-.10*	-.09	404
D	Male	-.01	-.05	535
	Female	.01	-.08	352
E	Male	-.05	-.03	490
	Female	-.08	-.05	372

*Significant at .05 confidence level.

**Significant at .01 confidence level.

Table 24

Multiple Correlations for Renewal Rules Test Scores

Regressed on Accidents and Violations

(By Sex and Test Form)

Test Form		Accidents and Violations
A	Male	.06
	Female	.04
B	Male	.10
	Female	.08
C	Male	.16*
	Female	.11
D	Male	.05
	Female	.10
E	Male	.05
	Female	.09

*R significant at $p < .001$ confidence level.

It is only when the background data are combined with the rules test scores, as predictors of a combined accident-violation criterion score, that some useful predictive possibilities emerge. Table 25 lists the canonical correlations obtainable from those best weighted combinations of the set of six predictor variables (five background variables plus the rules test) and the accident-violation criterion variables. These relationships are shown in terms of maximum and minimum coefficients obtainable.* The significant maximum canonicals (R max.) are of primary interest for discussion here.

All rules test forms,when combined with the five background variables for males, result in highly significant maximum R's ($p < .001$) that reach moderate levels in the .30's. The variance accounted for (or the extent to which prediction would be enhanced by R's of such magnitude) ranges from approximately 10% to 15%. This represents an improvement in predictive accuracy of 4 to 5 fold as a result of combining background data with the rules test. By contrast, the addition of background variables for the female samples produces only one significant relationship with the accident-violation criterion ($R = .25$, $p < .01$ for test form C). The fairly large differences in the size of these R's for males and females make it apparent that the background data are far more effective predictors for a male sample of drivers than for females--a finding that has, generally, been supported in several studies undertaken for the State of California (Coppin et al.,

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*The set of minimum canonical R's (R min.) represent the lowest likely set of relationships achievable from the fit of these predictors to the criteria. Maximum (or first) canonicals (R max.) tend to be somewhat inflated estimates that are not likely to be reproduced in cross-validation at quite such high levels.

Table 25

Canonical Correlations for Renewal Rules Test Applicants:

Composite Accidents and Violations with Renewal Rules

Test Scores and Five Background Variables

(By Sex and Test Form)

Test Form		R_{max}	R_{min}
A	Male	.36**	.10
	Female	.15	.11
B	Male	.39**	.17*
	Female	.19	.13
C	Male	.33**	.19*
	Female	.25*	.12
D	Male	.34**	.14
	Female	.22	.14
E	Male	.32**	.09
	Female	.18	.06

*Significant at $p < .01$ confidence level.

**Significant at $p < .001$ confidence level.

1967). Further support for that conclusion is seen in the values of the minimum obtainable canonical R's, wherein the only two significant correlations obtained are for males on test forms B (R = .17) and C (R = .19).*

In essence, then, by combining rules test scores with background data, there can be reasonable confidence that, for males, correlations significantly better than zero (i.e., no relationship) can be achieved in predicting a composite accident-violation criterion. Variance explained by such predictors would be expected to range from about 3.5% to a maximum of 15%. Although the predictive advantage at such levels can be used cautiously for certain decisions regarding drivers (e.g., classification, guidance and educational needs), these variables remain of limited practical value in a selection or screening system whereby some form of cutoff score must be arrived at in deciding whether or not a license should be granted. Levels of predictive efficiency, for even the largest of the correlations found when the renewal exams are combined with background data, would result in denial of the renewal license to too many "good" drivers in order to eliminate a reasonable proportion of those who are likely to incur accidents and/or violations.

Despite the limited practical utility in evidence here, an equal advantage in deriving information of this sort lies in its value for improving the understanding of important characteristics of the driver population and for providing clues to more fruitful lines of research and development

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*The differences in predictive value by sex can be attributed, in part, to a statistical artifact that arises from (a) the extremely skewed (Poisson) distribution of accident and violation frequencies and (b) the significantly differing frequency of accident and violation occurrences for the two groups. Males drive more than females and incur more accidents and violations (especially accidents). This higher frequency of occurrence for males tends to increase accident-violation criterion score variability and, concommitantly, to enhance the stability (or reliability) of that criterion. The net effect is a tendency to enhance the potential predictability of these criteria for males.

that bear on program operation. It was clear, for example, that supplementary (background) data combined with the rules test scores were needed in order to raise the correlations to levels with any reasonable predictive value. A better understanding of those multivariate relationships and the influences of driver characteristics that help produce them can be arrived at by examining the intercorrelations between the rules test score, the five background variables and the accident and violation criteria.

The two 9 x 9 intercorrelation matrices are presented in Tables 26 and 27 for males and females respectively. For convenience of presentation the matrices selected incorporate the results obtained only with rules test form A, since these were considered reasonably representative of the matrices obtained for each of the other four test forms. Some of the reasons for the more extensive impact of background variables, as performance predictors for male drivers, become apparent when the two matrices are compared.

It can be seen from the number and pattern of significant relationships that there is greater potential influence of individual background variables for males on the accident and violation criteria. Thus, driving experience for males ("years of driving") is significantly related to accidents and violations (or both used additively) and to the rules test scores. The variable of age which, as expected, is very highly correlated with years of driving experience ($r = .94$), results in an almost identical pattern of significant correlations. In effect, those males who are older and have been driving for a longer period of time are clearly "better" drivers (in terms of recorded accidents and violations) but poorer test takers. Such relationships do not appear consistently for the female driver sample, and the only significant correlation found ($r = -.10$) indicates a slight tendency for younger females to be convicted of more violations.

Table 26

Intercorrelation of Background Variables, Accident and Violation Frequency and Scores on Renewal Rules Test Form A

(Males, N = 522)

	Years of School	Years of Driving	Age of Car	Miles Driven per Week	Rules Test	Driver Age	Number of Violations	Number of Accidents	Total Accidents Plus Violations
Years of School	1.00								
Years of Driving	-.19**	1.00							
Age of Car	-.24**	.01	1.00						
Miles per Week	-.02	.06	-.04	1.00					
Rules Test	.32**	-.17**	-.11*	.08	1.00				
Driver Age	-.23**	.94**	.02	.03	-.19**	1.00			
Number of Violations	.11*	-.31**	-.02	.12**	.01	-.32*	1.00		
Number of Accidents	.05	-.12**	-.01	-.02	-.06	-.12**	.33**	1.00	
Total Accidents Plus Violations	.11*	-.29**	-.11*	.10*	-.01	-.30**	.91**	.52*	1.00

*Significant at .05 confidence level.

**Significant at .01 confidence level.

Table 27

Intercorrelation of Background Variables, Accident and Violation Frequency and Scores on Renewal Rules Test Form A

(Females, N = 368)

	Years of School	Years of Driving	Age of Car	Miles Driven per Week	Rules Test	Driver Age	Number of Violations	Number of Accidents	Total Accidents Plus Violations
Years of School	1.00								
Years of Driving	-.06	1.00							
Age of Car	-.19**	-.04	1.00						
Miles per Week	.17**	.09	-.16**	1.00					
Rules Test	.33**	.02	-.16**	.04	1.00				
Driver Age	-.22**	.81**	.08	.01	-.12*	1.00			
Number of Violations	.06	-.05	-.10*	.03	.03	-.10*	1.00		
Number of Accidents	.04	-.04	-.09	.06	.04	-.05	.44	1.00	
Total Accidents Plus Violations	.06	-.04	-.10*	.01	.01	-.08	.92*	.63	1.00

*Significant at the .05 confidence level.

**Significant at the .01 confidence level.

Relationships found between formal education for males (years of school) and several driver characteristics are also helpful in understanding the rules test results and driver performance. Those males with more formal education tend to be the ones who score higher on the rules test (in support of the previously stated assumption that the measure is, to a significant extent, one of verbal-intellectual skill). Males with more formal education also tend to be younger, to drive newer cars and to have been driving for fewer years. Probably because of the relationships of age and driving experience to the criteria (as previously shown) those with more education also tend to incur more violations ($r = .11$, $p < .05$) and more accidents plus violations ($r = .11$, $p < .05$). For females, the pattern is somewhat similar, with the more educated females scoring higher on the rules test, tending to be younger and to drive newer cars. Unlike the results for males, however, formal education is unrelated to violation convictions or accidents.

Exposure, as defined by "miles driven per week," relates primarily to the number of violations incurred by male drivers ($r = .12$, $p < .01$) but is unrelated to either accidents or violations for females. A reasonable suspicion,stemming from the pattern of weak relationships for miles driven over any period of time, is that it represents an incomplete index of exposure to potential accident or violation producing situations and should be supplemented by variables that take into account the traffic density likely to be encountered by each driver (e.g., population of the area where most of the miles are driven; number of vehicles registered in that area).

The age of the automobile as a background variable is found to bear some minor relation to accident-violation performance for both males and females, although at low levels of significance ($p < .05$). These results offer some

support to the logical expectation that more accidents and violations occur for persons driving older cars.

In interpreting any of the relationships presented above, it is necessary to recall that validation of these renewal rules test forms are dependent on a retrospective analysis and the addition of relatively few background variables. It should also be kept in mind,that the rules test measure itself was expected to hold little promise in demonstrating meaningful correlations with complex driver performance criteria because of the relatively poor quality of its measurement characteristics. In addition, total dependence on accident and violation criteria, with their highly skewed distributions, generate statistical properties which make for difficulties in analyses and interpretation whatever the study design. Nevertheless, within these constraints,the relationships did form fairly logical and interpretable patterns that are indicative of at least some degree of consistency and stability for the limited range of predictor and criterion variables available. The implication is that incorporation of measures of better quality and wider variety could have enhanced the level of relationships and sharpened the patterns found here.

CONCLUSIONS AND RECOMMENDATIONS

These initial analyses of written rules tests,presently used for licensing purposes in the State of North Carolina, have indicated that:

(1) The adequacy of the rules tests, as measurement tools for purposes of granting or renewing a driver's license, leaves room for considerable improvement. On the basis of item analyses, the various forms of the rules test tended to contain too large a proportion of items that are excessively

easy for the license applicants, with serious effects on item and test variance. These shortcomings were found to be particularly true of the license renewal examination. However, levels of internal consistency (reliability) for the measures were found to be adequate and reasonably similar from test form to test form. As a concomitant of that consistency, most of the items appeared to be measuring similar aspects of applicant knowledge which was reflected in moderately high levels of item-total test score correlations. Just what particular knowledge or skill areas are being measured was, unfortunately, not clear from the item groupings obtained as a result of factor analyses. Factor patterns for the rules tests were almost entirely uninterpretable and there appeared to be no coherent, identifiable, areas of driver knowledge or skill being measured. The one possible exception was a dominant factor,found for each of the initial licensing rules test forms, that was tentatively identified as "general knowledge" of the driver handbook and was believed to stem primarily from applicant verbal-intellectual skills. For the written renewal exam, the factor patterns were neither similar from form to form nor interpretable in any way.

(2) The retrospective,or post hoc,validation of the renewal rules test forms was limited to criteria based solely on driver records of accidents and violations for a four-year period prior to the administration of the renewal examination. Logical problems were stressed in generalizing from after-the-fact validity analyses to predictive assumptions about the measures. Accepting those limitations, however, the findings indicated that only one renewal test form (Form C) showed any degree of potential value (although slight) by virtue of its significant correlation with violation convictions for females and with accident occurrences for males. The levels of

relationship are such that they provide little value for any practical predictive application in driver appraisal, especially for screening purposes.

(3) Only with the addition to the rules test scores of driver background data (i.e., age, formal education, years of driving, age of car, and miles driven per week),were any reasonable levels of relationship with the accident-violation criteria found. Correlations based on the best weighted combination of accidents and violations as criteria and the best weighted combination of the rules test score plus background variables as predictors, produced maximum canonical R's in the .30's that were uniformly significant across all test forms for the male driver applicants. Even at those levels of validity, the predictive value of the rules tests would be considered highly limited for the screening of drivers in terms of who should,or should not,be granted a license. Some bases for the multivariate results and the striking differences by sex in the potential predictive value of tests and background data become clearer from an examination of the univariate correlations. Thus, individual background variables in general--especially age and years of driving--were found more consistently and more highly correlated with accidents or violations (and the two scores combined) for males than for females.

Any recommendations for test improvement, based on results achieved with the present data,must be considered preliminary. Their confirmation (or modification) would depend on initial licensing rules test validation in a predictive, or pospective, analysis (i.e., a posttest follow up) planned as a supplement to this report. Given that caution, the limited recommendations applicable to the written rules tests are:

(1) There is a need to construct test items with more defensible measurement characteristics than were found in the present rules tests. A strong implication for any such recommendation is that a clear definition of the purposes of the written driver licensing tests can be arrived at. If the sole basis for test use is to be a definition of the extent to which an applicant can recall the content of the Driver's Handbook, then proper content validation procedures for test construction would be sufficient (Cronbach, 1971). If awareness of "good driving procedures" and "good judgment" in vehicle handling are to be tested, then it is highly questionable that the present content of either the tests or the handbooks cover an adequate range of material appropriate to that purpose. If, on the other hand, the intention (however implicit) is to measure the extent to which the applicant <u>will be</u> a safe, law abiding driver, then the present rules tests have not--as yet--demonstrated any degree of merit sufficient to warrant their use for that purpose. (Any hope of incorporating all three purposes in a single type of test may be open to serious question on practical grounds, since it would probably require a major overhaul of present test and handbook content--as well as an extensive research program to determine what that content should be--before one could even begin to develop a suitably valid test.)

(2) In any future approach to developing rules, or knowledge-judgment measures there is a need to define specific and coherent content areas of driver knowledge that are intended for evaluation. The purpose is to build into the measure(s) meaningful item subgroups,or potentially useful subscales,that would identify those forms of driver knowledge and judgmental skills which are felt to be (or known to be) of importance to

driving performance and worthy of further developmental consideration. This, of course, implies being able to build measures based on more than reading ability, or verbal skills, as the single major component.

(3) Since a significant portion of the improvements in rules test validity appeared to stem from the addition of background variables, it is suggested that a wider range of driver characteristics and driving experience (e.g., accident culpability, accident-violation severity, density of traffic customarily encountered, etc.) be incorporated for investigation in any further predictive studies of licensing tests.

(4) There is a need to develop an assortment of more readily available, standardized measures of driver performance that can serve as defensible criteria, as opposed to depending entirely on recorded accident and violation data. Major statistical and logical difficulties in uses of accident and violation frequency have been pointed out in the present study and in previous research efforts (Coppin, McBride, & Peck, 1965). When these difficulties are coupled with the time and cost often required to obtain such data, with sufficient accuracy over a long enough period of driver experience, it becomes apparent that a range of more immediately available (short-term) criterion measures is needed. Performance criteria, that are representative of driving capability (based on real-world or simulated environments) and possessing more conventional measurement properties, would serve to provide the greater flexibility essential to test validation.

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APPENDIX A

Sample of Written Renewal Licensing Rules Tests

Series "A"
(Rev. 8/63)

Copy

North Carolina Department of Motor Vehicles
DRIVER LICENSE DIVISION

DRIVER EXAMINATION

Read ALL possible answers. Some questions may have more than one answer that is partly right, but there is one best answer. Make a check beside the ONE BEST answer. The question will be marked wrong if there is more than one answer given. Answer all questions.

1. Check the State maximum speed limit for passenger cars in a residential district.
   a. 25 mph b. 30 mph c. 35 mph d. 50 mph

2. The left arm held straight out, the first finger pointing, is the hand signal for
   a. a right turn b. a left turn c. slowing down d. stopping

3. The biggest difference between safe drivers and unsafe drivers is in
   a. age
   b. attitude toward highway safety
   c. physical condition
   d. mechanical ability

4. When following another car, you should
   a. keep a little more than one car-length behind for every ten miles per hour of speed
   b. allow just enough distance so that an overtaking car can pull in ahead of you
   c. stay at least four car-lengths behind at all speeds
   d. keep 500 feet between you and the car ahead

5. If two vehicles approach an intersection at the same time and from right angles, which one has the right of way?
   a. The vehicle on the right
   b. The vehicle traveling faster
   c. The vehicle on the wider street
   d. The vehicle on the left

6. When you are following a school bus that has stopped to take on or let off children, you should
   a. blow your horn, stop, make sure you can pass safely, and then go on
   b. slow your speed to 10 mph
   c. move to the left side of the highway and pass safely
   d. come to a complete stop

7. To pass on a three-lane highway, you should use the
   a. center lane
   b. center lane if passing is permitted in the direction you are traveling
   c. extreme left-hand lane
   d. right-hand lane

8. Compared to the braking distance at 20 mph, the braking distance at 40 mph is
   a. six times as far b. four times as far c. twice as far d. no farther

9. The law requires a turn signal to be given at least
   a. 100 feet before the turn
   b. 75 feet before the turn
   c. 50 feet before the turn
   d. 25 feet before the turn

10. A person's operator's license expires
    a. only when cancelled
    b. on his birthday one year after it is issued
    c. on his birthday four years after it is issued
    d. three years after it is issued

Series "A" continued.

11. The purpose of the Safety-Responsibility Law is
    a. to make sure that the costs of accidents are borne by those responsible for them
    b. to lower insurance rates
    c. to reduce speeding
    d. to raise insurance rates

12. At intersections where there are no traffic lights, pedestrians have the right of way
    a. only if they are in marked crosswalks
    b. over vehicles which are turning, but not over those going straight ahead
    c. over vehicles going straight ahead, but not over those which are turning
    d. over all vehicles if the pedestrians are in marked or unmarked crosswalks

13. What must you do as you approach a corner at which you intend to turn left?
    a. Pull over to the curb and stop until the street is clear
    b. Signal and get into the lane nearest the right curb
    c. Signal and get into the lane nearest the center line
    d. Speed up slightly

14. When entering the traffic lane on an interstate highway, you should
    a. enter the traffic lane at the same speed as the cars in that lane
    b. enter the traffic lane at a slightly faster speed then the traffic in that lane
    c. stop and make sure the traffic lane is clear
    d. enter the traffic lane at a slightly slower speed than the traffic in that lane

15. While driving at night, if you meet a car with blinding headlights, the best thing to do is
    a. continue at the same speed, but do not look directly at the oncoming lights
    b. dim your lights and speed up to get by quickly
    c. slow down, dim your lights, and do not look directly at the oncoming lights
    d. drive with two wheels on the right shoulder of the road to give yourself more room while meeting the car

16. A driver's license must be suspended for thirty days when he is convicted of
    a. driving without a license
    b. driving an automobile more than 75 mph
    c. failing to dim headlights
    d. failing to yield right of way

17. A person who drives in a manner that is likely to injure persons or property is guilty of
    a. drunken driving
    b. driving without a license
    c. no violation
    d. reckless driving

18. A basic rule for safe night driving is
    a. never outrun your headlights
    b. drive at 35 mph
    c. drive in the middle of the road except when meeting other cars
    d. drive at the posted speed limit

19. Very slow driving is especially dangerous
    a. in residential districts
    b. in business districts
    c. on lightly traveled country roads
    d. on highways just after passing the top of a hill, or just after rounding a curve

20. Which is generally considered the most dangerous place to pass?
    a. Just beyond a hilltop
    b. At the bottom of a hill
    c. Going downhill 150 feet beyond the hilltop
    d. On any part of a hill where you cannot see 500 feet ahead

Signature _____

APPENDIX B

Selection Proportions for Item Alternatives

Initial Licensing Test Forms 1 to 5

Table B-1

Initial Licensing Rules Test: Selection Proportions for Item Alternatives (Form #1)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.14	.06	.31	.48*
2	.08	.52*	.36	.02
3	.07	.02	.65*	.26
4	.29	.24	.10	.35*
5	.03	.51	.41*	.04
6	.15	.08	.68*	.07
7	.23	.70*	.01	.04
8	.91*	.03	.03	.02
9	.66*	.04	.28	.01
10	.03	.14	.49*	.32
11	.04	.81*	.12	.02
12	.25	.53*	.05	.15
13	.76*	.11	.05	.08
14	.08	.02	.85*	.04
15	.30	.53*	.10	.05
16	.63*	.08	.23	.03
17	.15	.53*	.23	.06
18	.14	.81*	.02	.01
19	.04	.08	.17	.70*
20	.05	.11	.70*	.12
21	.86*	.13		
22	.60*	.39		
23	.82*	.16		
24	.75*	.23		
25	.37	.62*		
26	.30	.69*		
27	.13	.86*		
28	.63*	.35		
29	.38	.61*		
30	.91*	.08		

Table B-2

Initial Licensing Rules Test: Selection Proportions for Item Alternatives (Form #2)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.04	.37	.22	.37*
2	.07	.79*	.07	.05
3	.58*	.13	.21	.07
4	.07	.03	.02	.88*
5	.02	.66*	.12	.19
6	.12	.02	.29	.56*
7	.07	.02	.83*	.06
8	.05	.05	.84*	.05
9	.08	.08	.21	.61*
10	.14	.57*	.21	.06
11	.21	.58*	.14	.05
12	.12	.01	.85*	.02
13	.21	.58*	.18	.02
14	.05	.14	.68*	.12
15	.87*	.04	.04	.03
16	.07	.13	.56*	.23
17	.16	.63*	.06	.13
18	.94*	.02	.01	.01
19	.47	.34*	.08	.08
20	.10	.15	.50*	.22
21	.15	.84*		
22	.70*	.29		
23	.60*	.38		
24	.67*	.31		
25	.31	.67*		
26	.20	.78*		
27	.80*	.18		
28	.40	.57*		
29	.63*	.36		
30	.11	.88*		

Table B-3

Initial Licensing Rules Test: Selection Proportions for Item Alternatives (Form #3)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.71*	.02	.21	.05
2	.04	.12	.64*	.19
3	.08	.20	.68*	.02
4	.69*	.04	.02	.25
5	.02	.67*	.13	.18
6	.67*	.03	.24	.06
7	.22	.10	.04	.62*
8	.04	.81*	.10	.04
9	.68*	.06	.21	.03
10	.93*	.02	.01	.03
11	.14	.09	.10	.65*
12	.12	.12	.05	.70*
13	.08	.05	.07	.79*
14	.10	.01	.01	.86*
15	.10	.02	.82*	.04
16	.08	.50*	.36	.02
17	.62*	.07	.17	.13
18	.05	.03	.02	.89*
19	.22	.43*	.25	.07
20	.08	.05	.82*	.04
21	.60*	.38		
22	.84*	.14		
23	.69*	.30		
24	.80*	.18		
25	.75*	.23		
26	.14	.84*		
27	.29	.69*		
28	.91*	.08		
29	.84*	.15		
30	.67*	.32		

Table B-4

Initial Licensing Rules Test: Selection Proportions for Item Alternatives (Form #4)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.01	.01	.97*	.00
2	.04	.11	.74*	.09
3	.14	.15	.04	.65*
4	.02	.04	.85*	.07
5	.68*	.03	.23	.05
6	.27	.39	.32	.02
7	.04	.02	.06	.87*
8	.05	.13	.00	.80*
9	.02	.04	.06	.87*
10	.44*	.16	.18	.21
11	.60*	.08	.18	.13
12	.37*	.13	.35	.14
13	.74*	.02	.21	.03
14	.76*	.03	.19	.01
15	.13	.10	.10	.63*
16	.70*	.04	.02	.24
17	.02	.66*	.13	.17
18	.36*	.22	.08	.33
19	.02	.91*	.01	.04
20	.03	.35	.20	.41*
21	.37	.61*		
22	.14	.85*		
23	.86*	.13		
24	.91*	.08		
25	.30*	.69		
26	.75	.23*		
27	.08	.91*		
28	.66*	.32		
29	.88*	.12		
30	.84*	.15		

Table B-5

Initial Licensing Rules Test: Selection Proportions for Item Alternatives (Form #5)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.07	.02	.02	.88*
2	.05	.02	.01	.92*
3	.01	.68*	.12	.18
4	.04	.63*	.14	.18
5	.03	.18	.73*	.06
6	.03	.02	.03	.91*
7	.64*	.04	.23	.08
8	.03	.05	.88*	.03
9	.47*	.13	.01	.38
10	.02	.83*	.10	.04
11	.10	.15	.50*	.24
12	.03	.78*	.16	.01
13	.01	.26	.70*	.02
14	.09	.85*	.03	.03
15	.13	.03	.40	.43*
16	.06	.10	.08	.75*
17	.05	.14	.67*	.11
18	.09	.45*	.35	.08
19	.04	.02	.04	.89*
20	.63*	.12	.15	.09
21	.31	.68*		
22	.66*	.32		
23	.84*	.15		
24	.17	.81*		
25	.12	.87*		
26	.87*	.12		
27	.08	.91*		
28	.78*	.20		
29	.61*	.38		
30	.40	.59*		

APPENDIX C

Selection Proportions for Item Alternatives

Renewal Licensing Test Forms A to E

Table C-1

Renewal Licensing Rules Test: Selection Proportions for Item Alternatives (Form A)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.24	.69	.04	.03
2	.46	.43	.02	.08
3	.12	.81	.06	.01
4	.18	.15	.64	.02
5	.03	.02	.02	.91
6	.02	.90	.04	.03
7	.10	.49	.01	.39
8	.62	.12	.00	.24
9	.04	.00	.00	.95
10	.02	.02	.02	.93
11	.02	.02	.00	.95
12	.10	.02	.01	.85
13	.03	.02	.01	.94
14	.04	.22	.53	.19
15	.01	.95	.01	.02
16	.01	.02	.97	.01
17	.76	.02	.15	.07
18	.05	.79	.12	.03
19	.02	.91	.05	.01
20	.01	.94	.02	.03

Table C-2

Renewal Licensing Rules Test: Selection Proportions for Item Alternatives (Form B)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.04	.02	.81	.13
2	.09	.86	.02	.02
3	.01	.07	.06	.85
4	.01	.01	.01	.96
5	.84	.03	.12	.01
6	.00	.00	.00	.99
7	.46	.43	.02	.07
8	.69	.19	.05	.07
9	.08	.02	.02	.88
10	.90	.04	.04	.02
11	.76	.05	.17	.01
12	.12	.02	.01	.84
13	.04	.04	.91	.00
14	.50	.10	.26	.13
15	.04	.01	.93	.01
16	.16	.79	.01	.03
17	.07	.01	.00	.91
18	.71	.02	.00	.26
19	.01	.03	.03	.92
20	.04	.03	.01	.92

Table C-3

Renewal Licensing Rules Test: Selection Proportions for Item Alternatives (Form C)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.04	.02	.80	.14
2	.77	.18	.02	.02
3	.06	.80	.01	.11
4	.09	.61	.23	.05
5	.16	.17	.12	.53
6	.04	.05	.90	.01
7	.83	.02	.09	.05
8	.04	.01	.94	.00
9	.01	.00	.00	.99
10	.01	.03	.01	.95
11	.03	.02	.01	.94
12	.54	.04	.12	.29
13	.01	.87	.08	.03
14	.01	.01	.02	.97
15	.07	.03	.01	.88
16	.00	.01	.98	.01
17	.10	.75	.03	.11
18	.86	.06	.02	.05
19	.03	.08	.10	.78
20	.02	.92	.03	.01

Table C-4

Renewal Licensing Rules Test: Selection Proportions for Item Alternatives (Form D)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.11	.79	.08	.01
2	.90	.04	.03	.02
3	.06	.91	.03	.00
4	.23	.01	.13	.62
5	.01	.00	.01	.99
6	.17	.56	.04	.22
7	.13	.02	.83	.02
8	.08	.75	.16	.01
9	.90	.00	.05	.03
10	.03	.05	.86	.06
11	.01	.88	.08	.02
12	.00	.01	.97	.01
13	.87	.01	.10	.01
14	.01	.96	.01	.01
15	.05	.81	.01	.12
16	.56	.27	.12	.05
17	.01	.02	.00	.96
18	.03	.91	.03	.02
19	.02	.03	.02	.92
20	.59	.11	.01	.29

Table C-5

Renewal Licensing Rules Test: Selection Proportions for Item Alternatives (Form E)

Item	Alternative 1	Alternative 2	Alternative 3	Alternative 4
1	.10	.03	.86	.01
2	.03	.95	.01	.00
3	.08	.16	.73	.02
4	.82	.01	.09	.06
5	.94	.01	.01	.04
6	.00	.00	.00	.99
7	.13	.77	.07	.03
8	.14	.64	.20	.01
9	.88	.04	.06	.02
10	.00	.01	.98	.01
11	.02	.95	.00	.03
12	.04	.22	.49	.24
13	.01	.02	.01	.95
14	.05	.03	.90	.01
15	.01	.04	.01	.93
16	.03	.90	.04	.02
17	.11	.43	.05	.40
18	.27	.01	.10	.61
19	.64	.12	.00	.24
20	.11	.02	.84	.02

APPENDIX D

Personal Data Form for Renewal License Applicants

NORTH CAROLINA

DEPARTMENT OF MOTOR VEHICLES

Supplementary Information on Applicant for Renewal License

Name_____License #_____

Address_____

Date of Birth_____
(Month) (Day) (Year)

Sex_____ Race_____

Circle grade in school applicant has completed: 1 2 3 4 5 6 7 8 9 10 11 12

College: 1 2 3 4 5 6

Occupation (Please describe in some detail)_____

_____

Marital Status: Never Married___;Married___;Divorced or Separated___;Widowed____

Did applicant have driver education course? _____ _____
Yes No

If yes, where_____When completed_____
(City) (State)

How many years has applicant been driving?_____

Make of car applicant currently drives the most:_____

Year of car applicant currently drives the most:_____

How many miles, on the average, does applicant drive PER WEEK?_____

Approximately how many miles did applicant drive in THE PAST YEAR?_____

Score on written examination:_____ Circle series: A B C D E

Score on oral examination:_____ Circle series: F 1 2 3 4 5

Was road test given? _____ _____
Yes No

Passed:_____ Failed: Rules____; Signs____; Eyes____; Road____